CLAIMS

1. A cell separation apparatus, comprising:

a lower plate provided with a cell mixture holding portion, in which a cell mixture containing specific cells tagged with magnetic carriers is accommodated in an upwardly convex shape, at a top surface thereof;

an upper plate positioned above the lower plate to face each other and to adsorb the cell mixture accommodated in the cell mixture holding portion of the lower plate into a bottom surface thereof;

a magnetic field applying means positioned on a top surface of the upper plate; and

a gap adjusting means coupled to the upper or lower plate to adjust a gap between the upper and lower plates to be increased or decreased,

wherein the gap between the upper and lower plates is decreased by the gap adjusting means such that the cell mixture accommodated in the cell mixture holding portion is adsorbed in the bottom surface of the upper plate and then formed into a cell mixture layer, and

the gap between the upper and lower plates is increased by the gap adjusting means such that the specific cells moved toward the upper plate by means of a magnetic field applied to the created cell mixture layer through the magnetic field applying means and cells other than the specific cells moved toward the lower plate by means of gravity are divided and then positioned in the bottom surface of the upper plate and the cell mixture holding portion of the lower plate, respectively.

2. The apparatus as claimed in claim 1, wherein a cell mixture adsorbing portion is formed at the bottom surface of the upper plate such that the cell mixture holding portion of the lower plate is positioned to correspond to the cell mixture adsorbing portion of the upper plate.

3. The apparatus as claimed in claim 1, further comprising an upper housing with an

open bottom and a lower housing with an open top,

wherein the magnetic field applying means and the upper plate are installed within the upper housing such that the magnetic field applying means is positioned on the top surface of the upper plate,

the lower plate and the gap adjusting means are installed within the lower plate such that the gap adjusting means is coupled to the lower plate, and

the lower plate is vertically moved by the gap adjusting means to adjust the gap between the upper and lower plates in a state where the upper housing is coupled with the lower housing such that the bottom surface of the upper plate and the cell mixture holding portion of the lower plate are positioned to face each other.

4. The apparatus as claimed in claim 2, wherein the gap adjusting means comprises a lower plate support formed with a recess for accommodating the lower plate therein at a top side thereof and a bolt-shaped connection at a bottom side thereof, and a lower plate support moving dial having a nut-shaped connection threadedly engaged with the bolt-shaped connection of the lower plate support; and the lower plate support is vertically moved by turning or rotating the lower plate support moving dial.

5. The apparatus as claimed in claim 4, wherein the gap adjusting means further comprises a dial stopper for restricting the rotation of the lower plate support moving means such that the cell mixture layer can be maintained.

6. The apparatus as claimed in claim 5, wherein the dial stoppers are installed on a bottom surface of the lower plate support moving dial and a predetermined portion of the lower housing such that the dial stopper is brought into contact with the bottom surface of the lower plate support moving dial at a position where the rotation of the lower plate support moving dial should be prevented.

7. The apparatus as claimed in claim 3, wherein the gap adjusting means comprises a lower plate support formed with a recess for accommodating the lower plate therein at a

top side thereof and a roller at a bottom side thereof, a lower plate support moving bar for vertically moving the lower plate support in such a manner that the roller of the lower plate support is brought into contact with a plurality of steps with different levels decreasing from one side to another side, and bar moving dial having a pinion portion meshed with a rack portion formed on a side surface of the lower plate support moving bar; and the lower plate support is vertically moved as the level of the steps of the lower plate support moving bar brought into contact with the roller of the lower plate support is changed by turning or rotating the bar moving dial.

8. The apparatus as claimed in claim 7, wherein a groove for temporarily restricting a motion of the lower plate support is formed on each of the steps.

9. The apparatus as claimed in claim 8, wherein the lower plate support moving bar includes a lower plate support shaking portion further extending from the step with the highest level and formed with a plurality of grooves.

10. The apparatus as claimed in claim 1, further comprising:

a housing,

wherein the upper and lower plates are installed within the housing such that the bottom surface of the upper plate and the cell mixture holding portion of the lower plate are positioned to face each other; the magnetic field applying means is positioned on the top surface of the upper plate; the gap adjusting means is coupled with the upper plate; and the upper plate is vertically moved by the gap adjusting means to adjust the gap between the upper and lower plates.

11. The apparatus as claimed in claim 10, wherein the gap adjusting means further comprises a stopper for restricting an upward motion of the upper plate support to allow the cell mixture layer to be maintained.

12. A cell separation method, comprising the steps of:

(a) creating a cell mixture containing specific cells tagged with magnetic beads into a cell mixture layer by adjusting a gap between upper and lower plates to be decreased such that the cell mixture which is accommodated in a cell mixture holding portion of the lower plate in an upwardly convex shape can be adsorbed in a bottom surface of the upper plate positioned opposite to the cell mixture holding portion of the lower plate;

(b) moving the specific cells toward the upper plate by applying a magnetic field to the cell mixture layer created in step (a) from the upper plate and simultaneously moving cells other than the specific cells toward the lower plate by means of gravity; and

(c) allowing the specific cells moved toward the upper plate and the other cells moved toward the lower plate in step (b) to be divided and then positioned in the bottom surface of the upper plate and the cell mixture holding portion of the lower plate, respectively, when the cell mixture layer is separated by increasing the gap between the upper and lower plates.

13. The method as claimed in claim 12, further comprising the step of, after step (a), adjusting the gap between the upper and lower plates to maintain a thickness of the cell mixture layer at an optimal cell separation state.

14. The method as claimed in claim 12, further comprising the steps of:

(d1) creating a specific cell mixture layer by decreasing the gap between the upper and lower plates after removing the other cells divided and positioned in the lower plate in step (c) or replacing the lower plate with a new one and then injecting a buffer solution containing no cells in the lower plate;

(e1) homogenizing the specific cell mixture layer by changing the gap between the upper and lower plates repeatedly several time while maintaining the specific cell mixture layer created in step (d1);

(f1) moving the specific cells toward the upper plate by the magnetic field applied to the specific cell mixture layer homogenized in step (e1) from the upper plate and simultaneously moving the other cells in the specific cell mixture layer toward the lower plate by means of gravity; and

(g1) allowing the specific cells moved toward the upper plate and the other cells moved toward the lower plate in step (f1) to be divided and then positioned in the bottom surface of the upper plate and the cell mixture holding portion of the lower plate, respectively, when the specific cell mixture layer is separated by increasing the gap between the upper and lower plates.

15. The method as claimed in claim 12, further comprising the steps of:

(d2) creating an other cell mixture layer by decreasing the gap between the upper and lower plates after removing the specific cells divided and positioned in the upper plate in step (c) or replacing the upper plate with a new one and then additionally injecting a buffer solution containing no cells in the lower plate;

(e2) homogenizing the other cell mixture layer by changing the gap between the upper and lower plates repeatedly several times while maintaining the other cell mixture layer created in step (d2);

(f2) moving the specific cells toward the upper plate by the magnetic field applied to the other cell mixture layer homogenized in step (e2) from the upper plate and simultaneously moving the other cells in the other cell mixture layer toward the lower plate by means of gravity; and

(g2) allowing the specific cells moved toward the upper plate and the other cells moved toward the lower plate in step (f2) to be divided and then positioned in the bottom surface of the upper plate and the cell mixture holding portion of the lower plate, respectively, when the other cell mixture layer is separated by increasing the gap between the upper and lower plates.